

A review of the genus *Serrata* Jousseume, 1875 (Gastropoda : Marginellidae) from French Polynesia

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ABSTRACT. *Serrata translata* (Redfield, 1870) the single known French Polynesian species of the marginellid genus *Serrata* (Jousseume, 1875) is studied in detail. Three new sibling species of *Serrata* are described, one from the Tuamotu Archipelago and two from the Society Islands. The sympatric occurrence of two sibling species is discussed. The animals are figured for the first time.

INTRODUCTION

A recent private expedition to the islands of the Central South Pacific by the second author has enabled extensive sampling of the microgastropod faunal assemblages of the littoral and infralittoral zones in five out of the forty or so atolls of the Tuamotu Archipelago and four of the Society Islands (Fig. 2). A detailed study of the encountered populations of living Marginellidae and Cystiscidae has realised a wealth of new information which the authors propose to present in a series of forthcoming papers, of which this is the first.

The molluscan faunas of the archipelagos of the Central South Pacific are mainly known from the extensive works of the American conchologist William Harper Pease (1824-1871), who between 1860 and 1872 described five hundred species of marine and terrestrial molluscs. These included a member of the genus *Serrata* (Jousseume, 1875) as *Marginella pyriformis* Pease, 1868 from the Tuamotu Archipelago. Two years later, William Redfield corrected Pease's synonymy by renaming the species as *Marginella translata* (Redfield, 1870).

The Polynesian species presented in this paper share the characteristic features of *S. serrata* (Gaskoin, 1849) (Fig. 1), the type species of the genus, namely a gently curved, strongly denticulated labrum, and an aperture which is more or less evenly narrow along its length. The authors therefore propose to assign the new species described herein to *Serrata* Gaskoin "sensu stricto". Further discussion of the taxonomy of the "group *Serrata*" sensu Coovert & Coovert (1995) with its great diversity of radulae and shell morphologies falls beyond the scope of this paper.

In recent years the issue of the true identity of the French Polynesian representatives of the genus *Serrata* has become somewhat muddled, with the appearance of one, two and three banded specimens in collections. These shells (for example the single banded example in Lipe 1991, Pl. 7, p. 15, no. 26) are

usually labelled as *Serrata translata* (Redfield, 1870). In the current work we aim to clarify the identity of *Serrata translata* and to describe two related new species from the Society Islands one from the Tuamotu Archipelago.

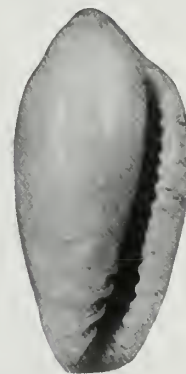


Fig. 1 *S. serrata* (Gaskoin 1849), type specimen.

Materials and methods

All live specimens were obtained by breaking apart friable dead coral lumps into a bowl and waiting for the animals to crawl out of the resulting grit and up the side

of the bowl. The coral lumps were taken from 0.2 to 12 metres by wading, snorkelling or scuba diving.

Dead shells were found in hand sieved sand from 1-10 metres, and in beach drift.

Photographs of the living animals were taken shortly after collection by the second author, using a Kodak DCS 410 digital single lens reflex camera with a 60 mm Nikkor 1:2.8 D macro lens and ring flash.

Abbreviations

BM(NH): Natural History Museum, London, England.



Fig. 2 Map of French Polynesia

MCZ: Museum of Comparative Zoology, Harvard, Massachusetts, U.S.A.

ANSP: Academy of Natural Sciences, Philadelphia.

AWC: Andrew Wakefield Collection.

TMC: Tony McCleery Collecton.

FBC: Franck Boyer Collection.

spm: live taken specimen

sh: dead collected shell

ad: adult subject

juv: juvenile subject

SYSTEMATICS

Genus *Serrata* Jousseaume, 1875

Serrata Jousseaume, 1875: 167, 230

[Type species originally designated as *Marginella serrata* Gaskoin, 1849]

Serrata translata (Redfield, 1870)

Figs. 3,4, 6-14

Marginella pyriformis Pease, 1868: 280.

[Non- *M. (Volutella) pyriformis* Carpenter, 1865]

Marginella translata Redfield, 1870: 259

Type material. Tomlin (1917) reports that the Pease collection in MCZ has a lot of twelve *M. pyriformis* from the Paumotu's labelled in Pease's handwriting (no. 24968). Johnson (1994) listed all the types of shelled Indo-Pacific molluscs described by W.H. Pease, but mentions only six type specimens: a lectotype selected by him (ANSP 29541), four paralectotypes (ANSP 391061), and one paralectotype (MCZ 24968).

After his death, much of Pease's duplicate material was known to have been traded and distributed widely. There is Pease material in the National Museum of Natural History, Washington D.C., and the Bernice Pauahi Bishop Museum, Honolulu, but the whereabouts of the remaining six of Pease's types is unknown to the authors.

Redfield (1870) based the renaming of *M. pyriformis* as *M. translata* on the type material of Pease.

The paralectotype MCZ 024968 (Fig. 3) was studied by the authors. It is a three banded specimen with 20 labial denticles, measuring 4.8 x 2.45 mm. The lectotype ANSP 29541 is also three banded and measures 4.0 x 2.0 mm. Johnson (1994) figures this lectotype (Pl.7, fig. 21).

Other material examined. Tuamotu Archipelago, Fakarava North. Outer beach, 1 ad. sh., TMC; Fakarava South. From dead coral lump in pass reef area, 15 ad. spm., TMC; outer beach, 1 ad. sh., TMC; 16°30.1'S 145°29.3'W, from a dead coral lump, in 1-2m, 1 ad. spm. and 1 juv. spm., AWC; Fakarava South-West. From a lump of dead coral on inner side of barrier reef flats in 1m, 1 ad. spm., AWC; From a lump of dead coral on inner side of barrier reef flats in 1m, 10 ad. spm., TMC; Makemo. From a dead

coral lump in pass reef area, 1 ad. spm., TMC (Figs. 11,12); From inner and outer beaches, 3 ad. sh., TMC; Toau. Outer beach, 1 ad. sh., TMC; Outside main reef, in sand at 8m, 1 ad. sh., TMC; Outside main reef, in sand at 10m, 1 ad. sh., AWC.



Fig. 3. *M. pyriformis*, paralectotype MCZ 024968

Original Description. 'Shell oblong pyriform, smooth, shining, white, with three yellowish bands at the suture, in the middle, and at the base; spire short; outer lip thickened externally, denticulate within its whole length; aperture narrow linear.'

Complementary notes. Pease described this species on the basis of shell shape. The type figure (Fig. 4) is indeed very pyriform. Of all 38 specimens of this species collected by the second author, none exhibited this extreme shape, and as the available type material is sub-pyriform to sub-cylindrical, the authors can only conclude that the lithographer exaggerated the pyriform outline of the shell. Samples taken by the second author reveal a great variability in shell profiles with sub-cylindrical (Figs. 6-8), cylindrical (Fig. 9), ovate (Fig. 10) and sub-pyriform (Fig. 11) specimens being found.



Fig. 4 *M. pyriformis*, original 1868 illustration

The number of labial denticles varies from 13 to 20, all strong except at the anterior extremity where they quickly become very faint and difficult to count.

The background colour of the shell is a translucent milky white, and is overlaid by three bands of yellow to dark brown. These bands are always visible, even in fresh dead collected shells. The anterior band emerges from the aperture at the level of the 'false fifth' plication, also colouring the posterior two plications but not the anterior two. It completely colours the anterior fifth of the body whorl, including the lip. The central band emerges from the posterior half of the aperture, covers the central fifth of the shell and colours the external varix a slightly darker shade. Colour does not extend, however, onto the edge of the lip or the denticles in this central zone. The posterior band emerges from the aperture at the level of the insertion of the lip. In many specimens viewed ventrally, this band can initially be rather faint, becoming more obvious further from the aperture. This band covers the subsutural fifth of the body whorl and the glazed suture. The spire and the protoconch remains translucent white in cleaned specimens, although in some deeply coloured specimens the sutural area of the spire is also coloured by the posterior band. The colour of the posterior band extends onto the edge of the lip, posterior to the first labial denticle. All three bands are visible within the aperture, showing through the translucent shell.

From a study of several animals: Type 2 animal (figs. 12-14). Tentacles long and slender, small black eyes laterally at base of tentacles. Siphon moderately long, foot slightly wider than shell, and normally 1.25x the length of the shell. Propodium widened at anterior border. Whole animal translucent except for milky opacity within the widened anterior border of propodium (mentum) and siphon (Fig. 13). Opaque white dots on the foot densely to sparsely distributed (Fig. 14). Spotting absent in the single live specimen obtained from Makemo (Fig. 12).

Presumed modified type 6 radula (after Coovert and Coovert 1995).

Type locality. Referred to as 'Paumotu's'. The Tuamotu Archipelago is the current name for this geographic area.

Distribution. Confined to the Tuamotu Archipelago in the South Central Pacific Ocean (Fig. 1). The species was found on the atolls of Makemo, Fakarava and Toau. It was not found in the atolls of Tahanea and Faiite, but was replaced in these two localities by *S. tahanea* sp. nov. As only these atolls were checked, it is not yet possible to comment further on the distribution of *S. translata* within the Tuamotu's.

Habitat. Found protected within crevices of dead coral lumps. In each case, specimens were found in areas where there was current and clear water. Where specimens were collected on the inside of the barrier reef they were associated with the channels which drain the water coming over the reef into the lagoon.

Remarks. The specimens encountered exactly match the type material and type locality, therefore the identity of *S. translata* as being the three banded species from the Tuamotu Archipelago is beyond doubt.

The opaque white dots found on the foot and tentacles of the animal (Figs. 13, 14), are variable in intensity, and are apparently lacking in at least one population (Makemo). The chromatism of the animal is therefore an unreliable character to use when separating specimens of this species from *S. tahanea* sp. nov., *S. raiatea* sp. nov., and *S. polynesiae* sp. nov., and in any case eonehological characters are perfectly adequate for identification purposes.

The largest shells were found in Toau, and the smallest in Makemo. The Makemo shells (Fig. 11) were significantly darker banded than the Fakarava examples, some of which had very pale bands indeed. Live *S. translata* were only found in Fakarava and Makemo.

Serrata raiatea sp. nov.

Figs. 15-17

Type material. Society Islands, Raiatea, in dead eoral lump in West Lagoon, holotype MCZ323755 (4.8x2.6 mm) (Figs 15-17).

Paratypes: 4 TMC, 4.9 x 2.45 mm; 4.8 x 2.45 mm; 4.9 x 2.6 mm; 4.4 x 2.25 mm; 1 AWC, 4.7 x 2.4 mm.

Other material examined. Society Islands, Raiatea West Lagoon. 2 ad. spm., 4.5 x 2.38 mm; 4.5 x 2.37 mm, TMC; In dead eoral lumps, in 1m, 1 ad. spm., 4.9 x 2.35 mm, AWC.

Description. Shell small to medium sized (4.5-5 mm), sub-pyriform, sub-cylindrical or ovate. Spire low to moderately elevated, of 2 whorls excluding paucispiral protoconch of 1.5 whorls. Strong external varix. Lip internally thickened, with 15-18 strong denticles. Four strong columellar plications and a very weak 'false fifth' plication all occupying almost half the apertural length. The anterior two plications extending well out of the aperture. Aperture either flaring slightly along its length or parallel sided with a weak anterior flare. Base colour milky white with two brown bands on body whorl:

The anterior band originates at level of 'false fifth' plication and it is usually the narrower of the two bands. The posterior band emerges from the posterior fifth of the aperture and colours almost all of the posterior half of the body whorl, stopping just short of the suture (Fig. 17). The spire is uncoloured, whilst the external varix is coloured darker brown all along its length, although this colour is lost on progressing towards the very edge of the lip (Figs. 15, 16).

Animal based on a study of several animals from Raiatea: Type 2 animal. Tentacles long, slender. Small black eyes laterally positioned at base of

tentacles. Siphon moderately long. Foot slightly wider than shell and normally 1.25x length of shell. Propodium widened at anterior border. Whole animal translucent, apart from milky opacity within the mentum and siphon. Spotting absent. External mantle not seen.

Presumed Modified type 6 radula. Coovert & Coovert (1995) extracted the radula (Fig. 5) from a specimen from Raiatea, but the decoration of the shell was not given. We therefore cannot attribute this radula specifically to either *S. raiatea* sp. nov. or *S. polynesiae* sp. nov.

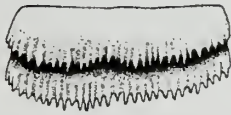


Fig. 5 Radula of *Serrata* sp. from Raiatea (Courtesy G.A. Coovert).

Type Locality. Raiatea, Society Islands.

Distribution. Five localities were checked in the Society Islands: Tahiti (Hitii), Tahiti (Maeva), Moorea, Huahine, and Raiatea. *S. raiatea* sp. nov. was only found on Raiatea, and subject to further investigation, we conclude that it is possible that *S. raiatea* sp. nov. is endemic in the Island of Raiatea.

Habitat. Found protected within the crevices of dead coral lumps, in shallow water.

***Serrata polynesiae* sp. nov.**

Figs. 18-23

Type material. Society Islands, Raiatea, in dead coral lump in West Lagoon, holotype MCZ323756 (4.5x2.4 mm) (Figs. 18-20).

Paratypes: 1 TMC, 4.9x2.6 mm; 1 AWC, 4.9x2.4 mm.

Other material examined. Society Islands, Raiatea West Lagoon. 1 ad. spm., 4.45 x 2.35 mm, TMC (ex B. Lipe coll.); Raiatea. 3 sh., TMC.

Description. Shell small to medium sized (4.5-5 mm), sub-pyriform, sub-cylindrical or ovate. Spire low to moderately elevated, of 2 whorls excluding paucispiral protoconch of 1.5 whorls. Strong external varix. Lip internally thickened, with 15-18 strong denticles. Four strong columellar plications and a very weak 'false fifth' plication all occupying almost half the apertural length. The anterior two plications extending well out of the aperture. Aperture either flaring slightly along its length or parallel sided with a weak anterior flare. Base colour milky white with a single wide brown band on body whorl. The band, which is slightly darker in colour at its edges, originates from posterior half of aperture (Fig. 18). Spire uncoloured, whilst the external varix is

coloured darker brown all along its length. This colour is present also on the very edge of the lip (Figs. 18, 19).

Animal based on a study of several animals from Raiatea: Type 2 animal (fig. 21-23). Tentacles long, slender. Small black eyes laterally positioned at base of tentacles. Siphon moderately long. Foot slightly wider than shell and normally 1.25x length of shell. Propodium widened at anterior border. Whole animal translucent, apart from milky opacity within the mentum and siphon. Spotting absent. External mantle not seen.

Presumed Modified type 6 radula. Coovert & Coovert (1995) extracted the radula (Fig. 5) from a specimen from Raiatea, but the decoration of the shell is unknown. We therefore cannot attribute this radula specifically to either *S. raiatea* sp. nov. or *S. polynesiae* sp. nov.

Type locality. Raiatea, Society Islands.

Distribution. Five localities were checked in the Society Islands: Tahiti (Hitii), Tahiti (Maeva), Moorea, Huahine, and Raiatea. *S. polynesiae* sp. nov. was only found on Raiatea, and subject to further investigation, we conclude that it is possible that *S. polynesiae* sp. nov. is endemic in the Island of Raiatea.

Habitat. Found protected within the crevices of dead coral lumps, in shallow water.

Remarks. Both *S. raiatea* and *S. polynesiae* have been found living within a 100 square metre area of reef system in Raiatea. Intergrading specimens (in the form of single banded shells where the band starts at the suture, or two banded shells where the posterior band starts some distance from the suture) have been looked for but not found. It appears therefore that here we have a case of a true sympatric occurrence of two very closely related sibling species. The principal differences between the two species are based on the chromatism of the shell with respect to the relative position of the band(s). A secondary differentiating character is the uncoloured lip edge in *S. raiatea* compared with the coloured edge in *S. polynesiae*. Their affinity to *S. translata* from the Tuamotu's is clear, but this is not as close as their relationship to each other for the following reasons;

1. The columellar plications of *S. raiatea* and *S. polynesiae* lie at a noticeably different angle to the long axis of the shell than those of *S. translata*: In *S. raiatea* and *S. polynesiae* the plications tend to lie more at right angles to the long axis (Figs. 15, 18), whereas in *S. translata* they tend to lie more obliquely to it (Figs. 6, 9-11).
2. The yellow brown banding does not colour the columellar plications in *S. raiatea* and *S. polynesiae*

but it does colour the posterior two plications in *S. translata*.

3. *S. translata* has an opaque white spotted animal (except one specimen from Makemo), whereas in *S. raiatea* and *S. polynesiae* the animals are identical and these spots are always absent.

4. It has been observed that the 'pod' which surrounds the eye is larger in *S. raiatea* and *S. polynesiae* than it is in *S. translata*.

5. In most cases the shells of *S. raiatea* and *S. polynesiae* are smaller than shells of *S. translata*, sometimes by as much as 1 mm.

6. *S. raiatea* and *S. polynesiae* occur sympatrically, whilst *S. translata* occurs approximately 200 nautical miles away in the Tuamotu's, and separated from the former by deep ocean. As well as the phenotypic differences noted in 1-5 above, *S. translata* is likely to have evolved genotypically further from the two Society Island species due to this geographic separation over geological time.

***Serrata tahanea* sp. nov.**

Figs. 24-30

Type material. Tuamotu Archipelago, Tahanea, in dead coral lump in shallow water, holotype MCZ 323757 (3.6 x 1.85 mm) (Figs. 24-26).

Paratypes: 1 MCZ 323758; 2 AWC, 4.0 x 2.0 mm; 3.7 x 1.75 mm; 1 FBC (unmeasured); 6 TMC, 3.8 x 2.0 mm; 3.5 x 1.9 mm; 3.8 x 1.95 mm; 3.8 x 1.8 mm; 3.65 x 1.8 mm; 3.6 x 1.8 mm.

Other material examined. Tuamotu Archipelago, Tahanea, 35 ad. spm., TMC; pinnacle reef at 16°51.6'S 144°40.5'W 28 ad. sh., TMC; pinnacle reef at 16°51.6'S 144°40.5'W 2 ad. sh., AWC; reef near first pass, 1 ad. sh., AWC; Faiite, from beach outside the motu's, 2 ad. sh., TMC.

Description. Shell small (3.5-4.0 mm), sub-pyriform to sub-cylindrical with a low to moderately elevated spire of 2 whorls, excluding protoconch. Paucispiral protoconch of 1.5 whorls. Strong external varix. Lip thickened internally, with 17-20 strong denticles. Four strong columellar plications and a very weak 'false fifth' plication, together occupying nearly half the aperture. The anterior two plications extending well out of the aperture. Aperture parallel sided with

only a slight anterior flare. Colour uniformly pale translucent golden-tan.

Animal: Based on a study of several animals from Tahanea. Type 2 animal (Fig. 29, 30). Tentacles long and slender. Small black eyes, siphon moderately long, foot as wide as shell and 1.5x as long. Propodium widened anteriorly. Animal translucent except for milky opacity within the mentum. Spotting absent. External mantle not seen.

Presumed modified type 6 radula (after Coovert & Coovert, 1995).

Type locality. Tahanea, Tuamotu Archipelago (Fig. 1).

Distribution. In the present state of our documentation, only known from the atolls of Tahanea and Faaite, Tuamotu archipelago (Fig. 1).

Habitat. Only one living colony was found, and this was located on a reef just inside one of the three passes. The water here was particularly clear, as it is throughout Tahanea lagoon. The specimens were found protected within the crevices of dead coral lumps in depths from 0.2 to 12 metres, and most of the dead corals had some green weed growth attached.

Remarks. This species is similar in shell shape to *S. translata*. The configuration of the columellar plications and the number of labial denticles are also shared features. The diagnostic differences lie in the colouration of the shell (uniformly golden-tan, and never banded) and the smaller labial denticles, though the small size in relation to *S. translata*, *S. raiatea* and *S. polynesiae* is also an important factor. It is also clear that the animal (Figs. 31, 32) lacks the opaque white spots that are present on most specimens of the only other Tuamotu species, *S. translata*. This is, however, an unreliable (and unnecessary) character on which to base an identification since Makemo specimens of *S. translata* also do not have a spotted animal, and they can be reliably separated from *S. tahanea* on conchological grounds alone. The second author did not find *S. translata* occurring sympatrically with this species, nor were intergrading specimens of the two species found.

Figures 6-30

6-14. *Serrata translata* Redfield, 1870

6-8. Fakarava, 5.0x2.6mm, TMC; 9. Toau, 5.9x3.0mm, TMC; 10. Fakarava, 5.2x2.9mm, TMC; 11. Makemo, 4.2x2.2mm, TMC; 12. Makemo, live animal; 13. Fakarava, view of head and anterior part of foot; 14. Fakarava, view of posterior part of foot.

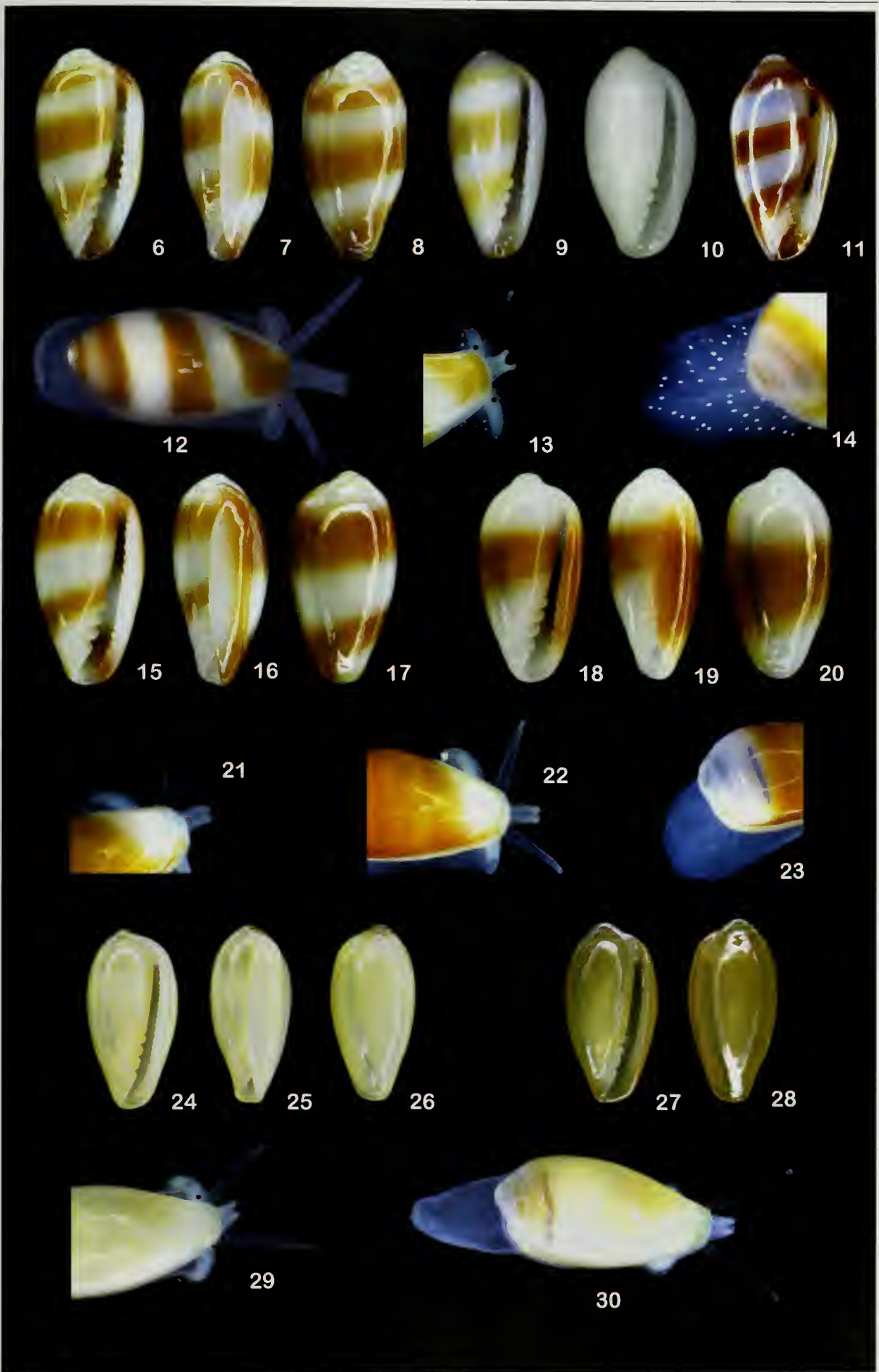
15-17. *Serrata raiatea* sp. nov., Raiatea, 4.8x2.6mm, holotype, MCZ323755.

18-23. *Serrata polynesiae* sp. nov.

18-20. Raiatea, 4.5x2.4mm, holotype, MCZ323756; 21-23. Raiatea, different views of the animal.

24-30. *Serrata tahanea* sp. nov.

24-26. *Serrata tahanea* sp. nov., Tahanea, 3.6x1.85mm, holotype, MCZ323757; 27-28. Tahanea, 3.65x1.85mm, showing colour when fresh; 29-30. Tahanea, two different views of the animal.



Two dead, unbanded shells of a similar size to *S. tahanea* sp.nov. were found on Faiite, and the authors consider that these are best placed in this taxon rather than with *S. translata*.

The golden-tan colour of live collected specimens (Figs 27,28) fades rapidly after collection and cleaning of the shells to a translucent pale yellow (Figs. 24-26).

DISCUSSION

Shells of the four taxa *S. translata* Redfield, 1870, *S. raiatea* sp.nov., *S. polynesiae* sp.nov. and *S. tahanea* sp.nov. discussed herein can be easily separated on the basis of their size and colour pattern: *S. translata* always has three bands and is the largest (av. 5.1 mm). *S. raiatea* sp.n. has two bands and is slightly smaller (av. 4.7 mm) whereas its sibling species *S. polynesiae* has one broad band. *S. tahanea* has no banding, is a solid orange-tan colour and is the smallest of the four (av. 3.65 mm).

The Tuamotu's and the Society Islands are the first stronghold of Marginellidae in the Central South Pacific when progressing from East to West. Exploration of shallow water habitats in the Cook Islands, the Samoa's, Tonga (including the most southern point at Minerva reefs) and Fiji by the second author has not provided any further records. The majority of the atolls and islands in the Tuamotu's and Society Islands still remain unexplored for micromolluscs, and it would not be surprising if further locality records of the described species are made there in the future. It is also possible that further discoveries of new sibling species in the *Serrata* group may be made with future collecting efforts throughout French Polynesia.

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